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THE EFFECTIVENESS OF THE FEDERAL POWER COMMISSION*

452 - 70

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The Federal Power Commission can be credited with outstanding administrative performance in the past decade. Long known as the independent regulatory commission with the highest standards for legal procedures and rulemaking, the Commission had become paralyzed by its own requirements for detailed analysis and review when faced with setting prices for thousands of natural gas field sales each year. Early in the 1960's, however, the Commission invented the means for clearing out the natural gas cases, and by May of 1968 the Supreme Court had affirmed this "area rate" process of reviewing large numbers of gas field sales in a single case or docket. At the same time, wider jurisdiction had been claimed by the Commission over wholesale distribution of electricity; in the words of one electricity company executive, "the Commission, under Chairmen Swidler and White, greatly extended the concept of what constituted an interstate sale...[while] many state Commissioners still assert[ed] duplicate jurisdiction over such sales."[1] Here again the Commission set out findings in early cases that set standards for due process under new and extended regulation.

While the Commission managed to get new types of dockets completed, they have not been able entirely to dispel concern over the effectiveness of regulation. The new decade has begun with promostications of shortage of natural gas, not only in the trade magazines but also in a report from the Commission's own Bureau of Natural Gas.[2]

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[1] Private correspondence, dated November 18, 1969.

[2] Bureau of Natural Gas, A Staff Report on National Gas Supply and Demand (Washington, D.C., The Federal Power Commission, September 1969).

The electric power producers now lack the capacity to provide peaking service in a number of major population centers that had been accustomed to such service. Regulation has been given part of the responsibility for such an outlook in these industries.[1] At least the possibility exists that the Power Commission has devised admirable procedures for achieving economically deplorable results.

This essay begins the investigation of such a possibility. The Commission is viewed as an organization using resources and commanding their use by others for the purpose of changing incomes and outputs in electricity and gas markets. The time frame of reference is a single fiscal year in the late 1960's, so that -- except in case of "new" gas field and electricity regulation -- the costs and benefits are from one short run period of ongoing activities of the agency. The analytic frame of reference is the concept of efficiency - of gaining the most in services or outputs desired by consumers for expenditures on regulation.

These are rather narrow frameworks. To determine whether the Commission could have effectively spent more or less in the last Fiscal Year is not to document the gains from regulation in the long run. The reason for doing this limited study is that quantitative evidence can be brought to bear on the question of whether there would be net gains from a larger or smaller Federal Power Commission. The evidence

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[1] At least accusations are made in the magazines, if not the publications of the Federal Power Commission's Bureau of Natural Gas. Cf. Anthony Liversidge "Not Enough Gas in the Pipelines", Fortune Magazine Vol. LXXX #6, p. 120 et.seq. (November 1969) and Jeremy Main "A Peak Load of Trouble for Utilities", p. 116 et.seq. in the same issue. Cf. also E.W. Kitch, "Regulation of the Field Market for Natural Gas by The Federal Power Commission" The Journal of Law and Economics (October 1968) pp. 243-280; at 278 the author concludes "In the field market the regulation will only cause the loss of gas which would otherwise be produced. In the consumer markets the possible consequences are even more disturbing"

remains to be discovered that would make it possible to judge the economic gains from having any Commission at all.

The last section of this essay contains some conclusions on whether the "scale" of regulatory activities in gas or wholesale electricity is "over-extended". Tentative proposals are made for changing procedures or criteria for regulated prices so as to reduce the costs of regulation or to add to consumer gains at present costs. But these are tentative because Commission rules are changing. Decisions are not based on standards that are consistent or discernable. Even if the Commission is erratic in its decisions, however, these conclusions are important since they are based on the latest Commission decisions. In that case, any reversal in later decisions would have implications in direct contrast to those of past decisions.

Where this exercise does lead to proposals for economic reform, then the question remains as to what exactly should be done. If the Commission is "inefficient" in an economic sense, then it does not follow that Congress or the Commission should make changes. Full requirements for economic efficiency could not possibly be put into effect, since the Commission was not brought into the world cast in such a mold nor was it given a mandate to acquire what it had not inherited. But there might be little objection to making changes in Commission procedures which <u>add to</u> economic efficiency, as long as these do not restrict the legal rights and prerogatives of the parties to regulation. This argument at least is one source of optimism, in the face of foreboding forecasts for conditions in the electricity and gas industries in the 1970's.

Efficiency in Regulation

The independent regulatory commission has a mandate from Congress and the Federal courts to provide a complex set of services to the industry with which it is concerned, and ultimately to consumers of the final products of that industry. The commission could be found to be "efficient", in the technical sense of the term, if there were no alternative way of providing the given regulatory services at lower annual expenditures of Federal funds. But this is a narrow definition of efficiency, since the possibility exists that the Commission is minimizing purely legal and administrative costs of promulgating an unwanted or unnecessary set of rules.

The direct costs of the Commission are not total costs of regulation. The Commission at any time could show reduced expenses by rulemaking that required the companies being regulated to bear additional costs, or that required final consumers to bring cases. The Commission could spend a great deal less by carrying out their usual activities at a slower rate. Both possibilities show that the expenses of all parties involved in regulatory proceedings should be considered the observable "costs of regulation" in any well-defined time frame of reference. There are indirect costs - especially involved in delay - which are reflected in higher prices for final goods and services. They should be included in the final balance sheet for the Commission.

The activities of the Commission are supposed to prove beneficial to the consumer and to the economy as a whole. Commissions in general are organizations for limiting business decisions, or for

preventing the occurrence of certain patterns of market behavior in particular industries. The Commission's service is the nonoccurrence of particular levels of price, or particular qualities of products. It could be involved as well in designating the sources and amounts of products. The benefits to society can be measured by the difference between the value under regulation of the economy's goods and services and that value when the prohibited patterns occur. There are all kinds of measures of value, but the measure allowing comparison with expenditures is the dollar "surplus", that amount of money which consumers and producers together would be willing to pay over and above the actual amount involved in transactions, in order to maintain the conditions from regulation. Finding this in a particular case is difficult; but the approach of measuring the surplus by areas under demand functions $q = f(P)$ for quantity q and price P on regulated products is not always unsuccessful in turning up an estimate of value for policy analysis. The Commission is efficient if it is providing services at least cost, and if the services result in dollar consumer and producer surplus greater than these costs.

The Federal Power Commission's day-to-day activities are very loosely organized around a few long-established public policies, given in the Federal Power Act of 1935 and the Natural Gas Act of 1938 and restated by the courts in thirty years of precedent decisions. One policy is protection of consumers against prices that are "unreasonable"

and "unduly discriminatory".[1] To put this policy into effect on wholesale distribution of power and natural gas, the Commission has generally required that the companies' average prices be equal to average "costs of service", however these costs on wholesale service are discovered in general cost accounting records. Even more exactly, prices for sales in a specific contract ought to be set close to costs of service, because the "cost of service formula is the one best adapted in determining just and reasonable rates in this industry where costs are known."[2]

The protection of the consumer from price-cost disparities has not been the only policy in regulation. The Federal Power Commission was given the task of "assuring an abundant supply of electric energy throughout the United States with the greatest possible economy and with regard to the proper utilization and conservation of natural resources" in Section 202 of the Federal Power Act. Public intervention to provide more service at higher quality was even more direct in the Natural Gas Act; here the Commission can and should require

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[1] as shown by the more recent court decisions; cf. F.P.C. vs. Southern California Edison Company 376 U.S. 205 (1964) on the jurisdiction and standards of the Commission for electricity prices, and F.P.C. vs. Northern Natural Gas Company 346 U.S. 922 (1954) for "costs of service" and prices of natural gas pipeline companies.

[2] in the matter of South Carolina Generating Company 16 F.P.C. 52 (1956) at 58. The qualifying clause "where costs are known" is important; in the many instances when there are widely varying estimates of costs, prices are not set equal to one of these estimates. The best characterization of the general relation is that "costs of service" provide a lower bound for prices suspected of being "too low" and discriminatory, and a much more approximate upper bound for prices found to be "too high".

improvement and extension of a pipeline's service when it is in the public interest. The emphasis on quality has in fact appeared in F.P.C. certification of new facilities for producing electricity and transporting gas -- here detailed reviews are made of the entrant's financial resources and fuel capacity to "meet the demands which it is reasonable to expect will arise."[1] Also, the Commission has become involved in the planning and forecasting processes in these industries, to a very limited extent "encouraging" coordination in the operation or growth of larger systems.

The "price" and "quality" policies need not be the same when put into effect in the Commission's ongoing surveillance and case activities. The price reductions captured by a year's work can be characterized by a movement from P_1 to P_2 in Figure 1; that is, buyers in the absence of the Commission's ongoing surveillance activities would find prices "creeping up" to P_1 or prices "failing to be reduced" to P_2, but with a year's regulatory vigilance (and expenditure on surveillance and litigation) price would necessarily be at P_2.[2] The gains for the consumers from regulation are shown as $(P_1-P_2)Q_1$ where Q_1 is the amount of service demanded at the higher price; at least

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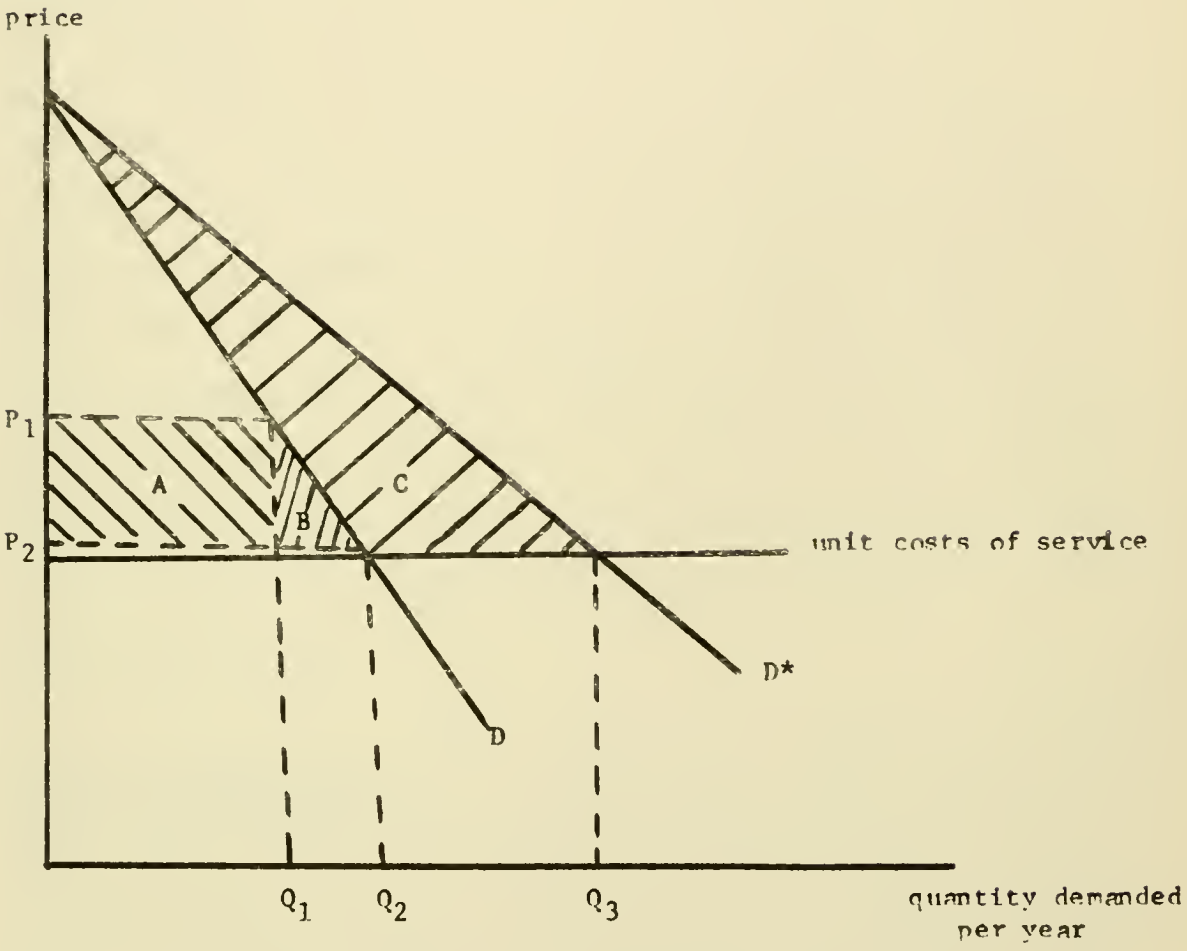
[1] Cf. in the matter of Kansas Pipeline and Gas Company and North Dakota Consumers Gas Company, 2 F.P.C. 29 (1939).

[2] The price would presumably be higher than this representative P_1 if the Commission were abolished, however. It is assumed here that the Commission is in operation, but at a much reduced level of expenditures on compliance, when P_1 is in effect. In fact, the upper limit of P_1 would be a price level clearly in violation of the precedents set by previous F.P.C. court cases dealing with that industry, so that a case without surveillance information could be brought if that level were exceeded.

this is all that has been claimed by the Power Commission on interstate gas and wholesale electricity sales.

Figure 1



But these gains in area "A" are not the only possible benefits from regulation.

Given that consumers' demands are represented by the negatively-sloped demand curve D, the Commission-induced price reductions increase the quantity demanded from Q_1 to Q_2. This uncovers a second consumers' gain, shown as area "B", that is not derived from income redistribution.

This is the dollar equivalent to what consumers would pay for $(Q_2 - Q_1)$ over and above actual payment $P_2(Q_2 - Q_1)$ rather than go back to price P_1 and quantity Q_1.[1] As such, it is an increase in the "quality of service" derived from direct price regulation and should accompany the area "A" benefits from "protection of the consumer".

The direct pursuit of "quality" is not by means of price reductions, however. Increasing the accessibility and reliability of service, by regulating the form and scale of capacity additions, should shift out demand from D to D*. This uncovers consumers' surplus shown by the area "C", and increases the quantity demanded to Q_3. Such gains may be had only at increased "costs of service", however, so that they are available only at prices higher than P_2. They not only do not accompany reductions in price, but in some cases are not realized if price is not maintained at the higher level.[2]

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[1] See D. M. Winch, "Consumers' Surplus and the Compensation Principle", American Economic Review, vol. 55, pp. 395-423 (1965). These gains are not to be realized unless certain conditions are present. First, prices have to be greater than the total economic costs of the additional output. The measured "costs of service" are not marginal costs, except by chance equality of accounting overhead allocation with the opportunity costs of using fixed factors in this production. There is no way of making certain that this condition is met, by recourse to regulatory accounting information. A second qualifying condition is as important: the $\Sigma\Delta P\Delta Q$ measure is a good measure of aggregate gains of consumers only if their distribution to some and not to others is judged to be acceptable. Here every dollar is taken to be of equal social value, no matter who receives it -- the steel company using gas or electricity for production, or the poor widow-orphan using it for light and heat.

[2] The analytical basis for this contradiction is shown in R. L. Schmalensee "Regulation and the Durability of Goods", The Bell Journal of Economics and Management Science, vol. 1, #1, Spring, 1970.

The critical question is whether any of these measures can actually be used to make the case for the regulatory status quo or alternatively for regulatory reform. In the representative regulatory commission, the information produced in the regulatory process is not for the purpose of making such assessments and is not useful for doing so. This is true for both costs and gains.

The costs of commission operations are calculated in straightforward accounting fashion in the budget and expenditure review departments of the Federal Government. But no assessment is made of costs imposed on the regulated firms -- the costs of defense or intervention in the regulatory proceedings.

Estimates of benefits depend critically on detailed information on market prices and quantities in the absence as well as the presence of the ongoing regulatory surveillance and accounting activities. Often there is some information on market behavior before and after some surveillance activity took place. A good part of this information is ambiguous, because it is not sufficiently detailed to allow separation of increases in demand as the market grows from changes in quantity demanded (where the latter follow from price reductions resulting from this activity). Also, prices after regulatory surveillance are related to "costs of service". The calculation of "costs of service" of the regulated companies is so arbitrary that it is not clear whether finding them leads to price reductions. The basic problem in the calculation is the allocation of joint capital expenditures among recipients of different kinds of service; there are no rules by which the resulting unit costs can be made to approximate the economic costs on which unregulated prices will be set.

In general the calculations by the Commission or by producing firms of the "costs of service" -- equal to variable costs plus an allocation of undepreciated capital expenditures -- may approximate unregulated prices, just as easily as they may approximate long term economic costs so as to lead to lower regulated prices. Last of all, the information on "quality" of service is in most cases limited to quantity information, or to recording of percentage "downtime" of systems. Nowhere is accessibility and reliability assessed in terms of final consumer demand.

But an initial attempt to assess benefits and costs will still be made in the case of the Federal Power Commission's regular activities. The costs of regulation can be estimated from Commission expenses, and from a first limited survey of the defendant's actual expenditures in recent cases. The benefits are assessed from the Commission's own public portrayal of its accomplishments. Wherever the F.P.C. shows a dollar of benefits that can be classified under "protection" or "quality" of service, it may be questioned and then reduced but not denied. This procedure results in an optimistic estimate of Commission benefits minus costs on its ongoing operations.

The Costs of Regulation by the Federal Power Commission

The Federal Power Commission's powers to regulate the companies producing or transporting natural gas and electricity are broad, given the general wording in its statutes, and the Federal Courts' willingness to let all matters of price and quality pass before the Commission

only so long as "due process" is observed. But the regulatory process for holding prices to "costs of service" makes up the major part of Federal Power Commission activities each year. The chronological steps in this process begin with an application for a CERTIFICATE OF NECESSITY AND CONVENIENCE by the company seeking to introduce the regulated product or service into some new market. The Certificate application is examined in hearings for "sufficiency" of demand for the proposed service and "capacity" of the company to provide the service. This is to assure the quality of service. After certification has been granted and service has begun, the reviews of prices are undertaken first by a hearings examiner, then the Commission, and finally on appeal by the United States Courts. The limit on average price is set close to the Commission's estimate of the costs of capital and variable inputs needed to maintain the service demanded. Finally, there are surveillance procedures for ascertaining that the price-profit ceilings go into effect. All of these reviews require expenditures on Commission, court, and company personnel and supporting resources.

The expenditures of the Commission varied from $11 to more than $14 million during fiscal years 1964 to 1968. Part of this outlay was for services having market value and not related to regulation, however. In particular, some were incurred in managing resources on Federal lands, Indian lands, or in providing maritime navigation within the jurisdiction of Federal power facilities. These outlays along with those on surveillance of the activities of other Federal agencies in the hydroelectric power business, cost $3.8 million

in the fiscal year 1968.[1] The regulatory outlays incurred by the Commission, or debited to firms by the Commission, were approximately $10.6 million in the last recorded fiscal year.

This amount was a small part of the total costs to the economy of a year's regulatory proceedings, however. Most of the costs of regulation were incurred by the producers of gas and electricity or by the transportation companies in these industries that were defendants in cases or the subject of "cost of service" reviews. There were roughly six classes of proceedings in a year which required the services of industry experts, lawyers, and corporate executives for extended periods of time. The cost of these resources varied from case to case, but estimates can be constructed of average costs for each type of proceeding which are representative of most of the instances. In some cases, actual costs for all of that type can be calculated. The total defendants' expenditures perhaps come to more than $36 million in a representative fiscal year. This amount might seem much larger than expected, but a category-by-category review suggests that it is not unreasonable.

The Costs of the Electric Power Regulatory Activities of the Commission

After thirty years of leaving regulation to the States, the

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[1] Cf. The Budget of the United States Government, 1970, Appendix, page 930.

Commission has carried out a campaign to set wholesale ceiling prices on all sales in interstate commerce since a 1964 Court decision affirming regulatory jurisdiction.[1] The catching-up process has centered activities on reviewing existing price schedules, rather than first certifying service and then reviewing prices. Approximately 2200 schedules have been filed each year, with supporting cost information. The Commission, on receipt of the filings, has reviewed virtually all of them. A minority are the subject of the 50 "rate" or price studies carried out each year, and also the basis for the 30 actual cases on "rates, terms, and conditions" brought before the entire Commission and appealed to the courts.

Each step of this procedure is costly. The Federal Power Commission itself spent $1.6 million in fiscal year 1968 on electric power utilities regulation (according to the Budget of the United States Government). Discussions and correspondence with a number of power companies indicates that, even if the filing of schedules involves no new rate or costing decisions, they cost anywhere from $25 to $1,000 of legal services and computer time to prepare. The total costs of more than 2,000 filings by the companies each year can be conservatively estimated at $50,000.

The rate studies and cases initiated by the Federal Power Commission are much more expensive. The Commission staff initiates the studies informally as part of annual surveillance procedures, when the first review of rate schedule and annual reports of costs

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[1] Cf. the U. S. Federal Power Commission 1964 Annual Report, pp. 85 and 165.

suggests that a more complete analysis is warranted. Their requests for detailed capital expenditures and output patterns are so extensive that some part of normal employee time in the company has to be devoted to this regulatory work. With 53 rate studies in progress in the 1968 fiscal year, most involving new calculations of "costs of service", the total indirect costs of this stage of regulation to the companies must have been extensive. A number of power companies show "charges related to filings" of more than $1,000 which are incurred while filling requests for information.[1] This stage in the annual regulatory review must cost the industry $50,000 per annum.

If the informal price review does not lead to the reductions sought by the Commission, then a formal rate case is initiated. Approximately 30 cases are in process each year, and 10 of these are usually completed. In the three years a case is in process, a full "cost of service" study is completed by both company and Commission, pre-hearing conferences are held, hearings are undertaken, and finally a Commission decision is rendered. All these steps involve investigations and testimony by company cost experts and executives, as well as the services of accountants, economists, and lawyers. A review of the 29 cases shown in the 1968 Federal Power Commission Annual Report shows that the full company costs for proceedings "in docket" that year ranged from $7,000 for a review of a single rate in Maryland to $305,000 for a full scale rate review on service to a group of cooperatives in North Carolina. Most cases were decided in the

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[1] Cf. the Form 1 Annual Reports for Electric Power Companies (1968) under the accounts "regulatory expense" (353) and "consultants expense" (355).

defendants favor; for them, there are additional costs of delay and of greater uncertainty as to future charges and costs of service. Then the 10 cases finished in a year must cost at least $1,500,000 when all costs over the case lifetime are included. The total costs of regulating electricity wholesale prices probably comes to an estimated $3.2 million per year, when both Commission and defendants expenses are included.[1]

The nature of the cases themselves points to the possible occurrence of further indirect costs of regulation. A large number involve disputes between small cooperative companies retailing electricity and large power-producing networks; the point of dispute is the necessity for the wholesale price to be equal to that charged some other buyer of the same or different size at some other location.[2] These disputes do little more than demonstrate to the power producers that, in order to avoid hundreds of thousands of dollars of litigation, they must offer the small buyers prices reflecting economies of scale which do not exist for those buyers. This condition must provide incentives not to connect to the small buyers -- at the indirect costs of higher generation expenses for locally-produced electricity.

The Federal Power Commission has embarked most tentatively to add to the "quality" of service by initiating cases requiring the larger producers to provide power to small retailers. To this

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[1] This does not account for the possibility of lower or higher costs in any one year. If all cases were "single rate" cases, costs for defense might be as low as $100,000; but if all were complex statewide rate reviews, then defense costs might be $3,000,000.

[2] Cf. E-7129, E-7183, E-7273, E-7308, E-7344, E-7421, and E7426 in Table 10 of the 1968 Annual Report of the Federal Power Commission.

point, the campaign has had little effect except on the defense costs of regulation. The most promising docket was E-7257, in which the city of Gainesville, Florida requested the F.P.C. to require interconnection with Florida Power Corporation, and the F.P.C. examiner approved the request along with a procedure for sharing the cost savings in electricity generation. The Commission reversed the examiner, and, in the fourth year of this proceeding, the city of Gainesville's plea is before the circuit court at New Orleans. The costs of this and the few other "extension of service" cases have been a little more than $100,000 apiece so far; if only two are settled in a Commission working year, then the costs per annum of this phase of regulation may be $200,000.

After prices have been set within the framework of regulation, the day-to-day operations of electric companies take place according to rules set once again by the Commission. Capital equipment used in operations has to be that specified in "costs" that determine rates. The Power Commission has been conducting field examinations of those capital expenditures actually made by companies, to ascertain that that they are the "original costs" for providing the regulated services. More than 200 electric utilities filed documentation on capital assets actually in use; more than 350 companies filed studies of classification of original capital expenditures among types of service as well. These studies had value to the firm in their day-to-day operations so that not all of their costs can be attributed to regulation -- for one, the companies

learn where their equipment is. But the resources devoted to these activities are clearly beyond those found in cost surveillance in unregulated companies, and they have not been justified by the companies as "cost effective" in terms of lost and found equipment. The F.P.C. costs of "electric power industry systems evaluation" were $1.3 million in fiscal year 1968. A small sample of companies shows that their costs on these activities cannot have been less than $5,000 per annum in each company undertaking these procedures in any one year.[1] There have been approximately 40 documentation and 75 classification reviews of present or proposed future facilities actually completed in a fiscal year. A minimum estimate of the resource costs of the F.P.C.'s electricity surveillance program must be at least $1.9 million per annum, as a result.

An overall review of the regulation-related costs of the power industry and Commission shows that approximately half are attributable to price control activities and the other half to attempts to improve the quality of service. The companies and Commission together seem to have spent $3.2 million on rate or price regulation in a typical year in the late 1960's, although variations in the costs of the individual cases may have made this amount as high as $4.7 million or as low as $1.8 million. They probably spend $3.4 million per annum

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[1] This is a sample average for thirty firms showing "regulatory expense" on Form 1 of the electric power company reports to the Federal Power Commission. These firms did not have underway other proceedings mentioned above, or reported costs related to system reviews.

on certificate and systems evaluations to extend the quality and quantity of service. The total costs of these aspects of regulation have been in the range from $5 million to $8 million, and have been close to $6.6 million.

The Costs of Gas Field Price Regulation

Regulation of prices charged by producers for natural gas sold to interstate pipelines has been in effect since the Supreme Court decision of 1954 in Phillips Petroleum Company v. Wisconsin (347 U.S. 672). But there was not effective regulation, with Commission-imposed limits on prices, during most of the 1960's.

The problem that delayed installation of price control was how to set ceiling prices based on individual company records of "costs of service", when gas comes from wells jointly owned by a number of producers each with different historical costs, or from different wells in the same market but with histories of different exploration and production expenditures. Faced with having to make arbitrary cost allocations, the Commission moved away from prices based on company "costs of service" to area price ceilings set in reference to country-wide average costs of exploration and development. Provisional prices were set for "new" and "old" gas field contracts in 24 areas in 1960. Formal Commission and Court proceedings have been underway in review of the provisional prices. The Supreme Court in the Permian Basin Area Rate Case (390 U.S. 747) affirmed the legality of this price-setting method last year, so that price ceilings can now be set

as a matter of course on historical average development costs over large regions.

Regulation of prices is only the most important of a number of Commission activities. The producing company with discovered and developed gas reserves has to go through a number of formal procedures beginning with obtaining a Certificate of Necessity to put the gas into the pipeline soon after a sales contract has been signed. The applications for Certificates now make up an inventory of approximately 2,000 per annum, with 1,200 reviewed by the Commission in the same year and most of the rest in the following year.

There have been two opposing trends in administering Certificates in the last decade. First, the reviews have become more detailed over time, dealing with contract prices as well as security of supply and demand in the assessment of "necessity and convenience."[1] As a result, filings to the Commission now include a showing that initial prices on new deliveries are "in line" with those in the field region, based on studies of contract pricing and other conditions by lawyers and company accountants. But in contrast to this extension, the Commission has devised a "temporary certificate" allowing extremely rapid installation of new service while the full certificate review is going on. The full Commission certificate reviews take time and hold up the production process, since reserves

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[1] That is, since the certificate price can only be reviewed when increased under the present interpretation of the Natural Gas Act, this is the only point at which an initial review takes place.

have to be secured and developed before certification, while production can only take place after the review is complete. The new "temporaries" reduce these costs of delay.

The balance of more complex permanent certificate reviews with substitution of temporary certificates determines the costs of regulatory delay at the present time. In the early 1960's, the costs of delay came to as much as ¢.17 per thousand cubic feet for every month of delay, and were the reason for a 3.5 percent price premium attached to regulated interstate sales over and above unregulated within-state sales.[1] The delay at that time was more than five months, and if anything the delay at the present time is six months, given that permanent certificates are processed more or less uniformly from one to twelve months after application.[2] But the present delay is ameliorated by temporary certification, so that the price premium

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[1] As documented by R. W. Gerwig, "Natural Gas Production: A Study of the Costs of Regulation" The Journal of Law and Economics (October 1962) pp. 86-88.

[2] The new gas certified each year has cost $C_d = \sum_{i}^{n} c_i q_i \left[1 - \frac{1}{(1+r)^d}\right]$ more as a result of regulatory delay, where c_i is the present value of unit costs of gas quantities q_i in "n" individual contracts, and "r" is the monthly percentage costs of delay during the delay period of length "d". Given other regulatory procedures, c_i has to be not greater than initial base prices set by the Commission for field areas; these prices average close to 17 cents per thousand cubic feet, if it is assumed that contracts were for reserves from new fields discovered in 1967 and 1968. More than 60% of the new fields were in Texas, 10% in Louisiana, and the remaining in other states; weighting the F.P.C. ceiling prices by these percentages results in the $.17 average. q_i is close to 16 trillion cubic feet, as shown on page 48 of the F.P.C. Annual Report for the fiscal year 1968 (an amount that has a present value of 6 trillion cubic feet). With delay costs "r" of one per cent per month for a "d" of six months, the certification procedure could cost as much as $58 million per year.

required by regulation cannot be half that in the early 1960's. At the most, the temporary certificates could reduce the regulatory delay to one month and the costs of delay to $10 million per annum; at the least, temporaries are worthless because they do not dispel the uncertainty of obtaining the final certificate and compound costs by making possible delivery under a contract that will be rendered null and void. In these worst circumstances, costs have to be those for waiting for a permanent certificate and exceed $58 million for delay.[1]

The step after certification in the Commission's regulation of natural gas is to set producers' prices. As was mentioned, this has been accomplished with maximum "area rates" on all gas in a large geographical region. These rates are then compared with 6,000 rate schedules each year to ascertain conformance to the rulings.

The Commission has used or required producers to use far more resources in this pursuit of the ceiling price than might reasonably be expected. The area rate proceedings have been massive and prolonged. The first case began in December 1960 with hearings on prices set by 351 companies under 705 dockets for gas in the Permian Basin of West Texas. Testimony and submissions were completed early in 1964 and were followed by a Commission decision in August 1965 setting a maximum price of 16.5¢ per thousand cubic feet (m.c.f.) on "new" gas-well gas and 14.5¢ per m.c.f. on "old" gas. The Supreme Court

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[1] Cf. the preceding footnote for calculations for the worst case. The most pessimistic estimate of all comes from assuming that the temporaries have zero value - where the producer is indifferent between a temporary and waiting for a permanent certificate. These costs are the costs of waiting.

affirmed this decision in May 1968 and the Commission then began the last round of putting these ceilings in effect in place of the "interim" or "in line" prices which held at 16¢ on new gas and 11¢ on old gas. The work on a single set of area rates has now almost been completed.

Four more area rate cases have been initiated and are moving along to the decision stage - albeit on a faster schedule, given that the Permian Basin proceedings had provided the rulemaking and even some of the documentation. The approach in each has been the same, and has centered on finding long term historical average costs of exploration, development, and production. This estimate is used to set future ceiling prices, after adjustments are made for costs of special conditions in the area. The search for these costs is burdened with exceptional problems. Foremost of these is the lack of economic analytical technique to find what is sought: the separable costs of gas alone in the oil-gas regions, at both the exploration and developmental stages. Without techniques to foreclose discussions to the quality of data alone, testimony on method and on opinions of those experienced in the industry becomes profuse. The second problem has been to relate historical costs to future prices. Both problems have multiplied the amount of testimony and greatly prolonged cross-examination and rebuttal testimony.

The costs of the proceedings have been very extensive. The Federal Power Commission's own expenses on gas regulation in the last few years have included more than $3 million per annum incurred for

staff devoted to preparing briefs and testimony on area rates as well as for preparation of decisions. The producers have undertaken extremely thorough and expensive investigations of drilling and production expenditures throughout the country. They have retained more than 50 law firms, more than a dozen economic and engineering consulting companies to provide testimony before the Commission. Their costs over all of these area proceedings have never been calculated; but the examiner in the Permian Basin proceedings found that the total costs of producer regulation were .14¢ per m.c.f., and uncontested industry testimony in the Texas Gulf Coast Area Rate proceedings showed that these producer costs come to .15¢ per m.c.f.[1] The area reviews applied on approximately 75 per cent of the 16 trillion cubic feet of producer commitments to the interstate pipelines in each of the last few years, so that total producer expenditures on the area rate reviews must have been close to $18 million.[2]

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[1] Cf. Area Rate Proceeding, et. al. (Permian Basin) Docket number AR 61-1, 34 FPC 159 (1965) at 197; and the testimony of S. F. Sherwin, Exhibit number 42-J (SFS-1), Schedule 17 in the Area Rate Proceedings Docket numbers AR 64-1 and AR 64-2. These average fixed costs of regulation include the costs of certification and of rate schedule review, as well as those in the area rate proceedings, so that they are too large to be an estimate of the private expenses of the rate proceedings alone. But they are not far out of line as a measure of total costs of producer regulation because most rate schedule proceedings were suspended and replaced by the area rate reviews.

[2] The producer commitments to interstate pipelines are given in the Annual Reports of the Federal Power Commission.

Since area rates have not been set to apply on all interstate gas sales, producing companies still file some individual rate schedules for review. Also, a number of cases have been filed as exceptions to the Commission-set maximum field prices, for reasons having to do with exceptional production costs or with specific terms of the sales contracts, or with conditions in state taxation or regulation. These cases have not been dealt with rapidly, presumably because of the priority assigned by the F.P.C. to setting maximum area prices. Consequently, only 500 suspended rate schedules had been dealt with in fiscal year 1968 while more than 7,000 other applications for rate increases remained in suspension that year. The inventory of suspended rates has not only been large, but has also involved more than $130 million of disputed payments; the costs of uncertainty and delay for those finally receiving these amounts must be substantial.

At the same time the individual rate reviews have continued to develop into formal producer "rate cases", many involving the documentation of production conditions outside of those setting area rates, or involving company "costs of service" where there are no area rates. Both involve finding "costs" for the individual production unit. The arguments for a premium on prices to pay for more costs - say, in more directional drilling for gas in deeper producing regions -- have been built on the most extensive statistical and accounting reviews. The documentation inflates the costs of making an individual "rate case" presentation. In the few rate cases for which costs are available, it

would appear that defending a rate schedule required expenditures of $25,000; the 80 cases dealt with in a fiscal year result in total defendants costs of $2 million at least.[1]

The total costs of producer regulation are unknown, and can be estimated only very imprecisely. The Commission itself spends $3.1 million per year on all aspects of producer regulation, and the companies probably spend $20 million on defending rate cases -- both the large area rate cases and the smaller, more numerous case disputes on suspended individual rate schedules. The costs also incurred by producers from regulating delay at the certification stage are more difficult to estimate; the range given here is from $10 million to $58 million, depending on the length of the delay. As a result, the total regulation costs are from $33 million to $81 million.

The Costs of Gas Pipeline Regulation

The regulation of the long distance natural gas pipeline companies resembles that of electric utilities much more than that of the gas producing companies. The market structure in gas transportation and electricity generation are similar. The interstate pipelines have been built to such a scale that some have regional monopolies in supplies to retail gas utility companies, while others face the

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[1] The source of the data has been private correspondence with a significant number of defendants in the cases listed in fiscal year 1968. The costs do not include those incurred in removing rate suspensions in informal Commission proceedings; since more than 500 suspensions are reviewed each year, these total costs could be substantial -- albeit unknown at the present time.

possibility of substitute sales by no more than two or three other pipeline sources. With few companies in more or less separate sub-national markets, and with each of these companies having some of the characteristics of natural monopolies, the Commission has proceeded with individual "cost of service" regulation.

The pipelines must first obtain Certificates of Necessity and Convenience for rights-of-way to construct both their gathering lines in the gas fields and distributing lines to retail gas companies. The hearings and findings of the Commission on these applications are made to determine whether the demands of retail gas utilities are sufficient to require full capacity operation of the proposed pipeline, and if there are sufficient reserves under long-term field purchase contracts to satisfy these demands. The Commission's quest for quality in service has the effect, of course, of imposing costs on the companies.

In order to prove "sufficiency", the pipeline presents a collection of field purchase contracts and wholesale sales contracts with long lifetimes. It has long been suspected that the time-lengths of these contracts have been longer than would be demanded by the pipelines, in the absence of this certification procedure, since the purpose has been to demonstrate full use of the proposed facility for its lifetime rather than least-cost use over the normal decade-long planning horizon in this uncertain industry. The requirement for twenty-year contracts reduces the risks of gas producers since their sales are secured, and increases the risks of pipeline and retailer

not being able to complete final sales of the secured gas at compensatory prices in the far future. The requirement reduces the risks of final consumers of discontinued gas service. These risks will be reflected in costs -- higher costs for pipelines and retailers in obtaining capital, and higher prices for the consumer having to pay for these higher costs.

The clerical procedures for proving "sufficiency" are themselves expensive. The contract information is accompanied by geological and legal studies establishing the ownership of gas underground and not yet produced. These studies require the services of experts and the final reported costs are attributed to the certification process. Part would be undertaken anyway, to establish property rights for any gas sale, but the extent of documentation here seems to be much greater. Again, these are costs involved in obtaining more complete knowledge of present and future delivery.

Certification of new facilities is completed while deliveries are made on outstanding service contracts. There were more than 400 certificate applications before the Commission in 1968 involving 11,000 miles of proposed new line; some were major extensions of more than 100 miles, but most were for a few miles of gathering line into new fields and were not central to the transport of large volumes of gas over 1,000 mile main lines. The central regulatory concern of the transporters is with the prices to be charged for mainline service.

Under the present ratemaking procedures, the company proposes

future price ceilings on a particular service based on new measures of historical average costs of providing that service. The measures derive from recent expenditures as allocated between types of service according to Commission rules -- the most important requiring half of the capital costs to be allocated on the basis of relative volume of gas purchased in the test year, and the other half on the basis of relative volume purchased during peak load periods.[1] The data used in finding the measures, and the actual calculations, are contested by the companies and Commission staff in informal and case rate reviews. Estimates of the rate of return required on pipeline investment by the markets for capital funds depend on assumptions as to alternative uses of funds, and calculations of final "costs of service" depend on how closely the allocation formulas are followed. Both are points of dispute; numerous financial and economic experts describe their judgments on the procedure or estimate likely to reduce prices and increase quality in the long run, leaving it to the examiner and Commission to judge the correct values.

The Federal Power Commission in recent years has exercised its judgment in a large number of informal rate filing actions as well as formal case reviews of pipeline rates. The natural gas pipeline

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[1] The so-called "Atlantic Seaboard formula" as given in Atlantic Seaboard Corp. et. al. 43 PUR (NS) 235 (1952). The costs assigned to service j are $C_j = VC_j + K/2(Q_j/Q_{i+Q_j}) + K/2(Q_{jt}/Q_{it+Q_{jt}})$ where VC_j are total variable costs actually incurred in j, Q's are volumes consumed by j and other i demanders throughout the year and also at peak load period t.

companies file close to 1500 rate schedules each year, and those dozen or so calling for rate increases are either allowed or suspended by the Commission almost immediately. The suspended rates are either withdrawn or become central issues in the 30 formal rate cases pending each year before the Commission, along with rate decreases called for by F.P.C. staff investigators. When cases are completed, the F.P.C. staff then carries out compliance reviews to ascertain that reductions "flow through" to final consumers of gas.

Altogether, these activities cost the Federal Power Commission close to $3.5 million per annum.[1] The sum total of the private costs of regulation for the gas pipelines was $2.5 million in the last recorded year.[2] Both changes in Commission procedures and in lawyers' and economists' charges can change the total; also, a slight change in the mix towards more complex cases in the range of filings made in a year could revise it upwards by a large amount. But these are not likely events, given that the Commission has worked out highly formal procedures for finding costs and that it entertains differences of views only in narrow topics of cost allocation, tax payments, or in rate of return levels. The 1968 cases were quite orthodox, and they cost the defendants about what can be expected.

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[1] The Federal expenditures for natural gas pipeline regulation are shown as $3.526 million in fiscal year 1968. Cf. The Budget of the United States Government, 1970, Appendix, page 930.

[2] Compiled from "regulatory expense" and consultants' charges shown by each of the interstate pipeline companies in the Federal Power Commission Form 2 Reports for 1968.

There are substantial costs in each of the Federal Power Commission's procedures. A first, but indicative, review of available information on expenditures of both regulator and regulated is shown in Table 1. The costs of government activities are roughly matched by those of private companies in all activities except gas field price regulation, where private expenditures are ten times greater.[1] The costs can vary greatly from those shown; in particular, the range of likely private expenditures is from $35 to $85 million per year. But further analysis is most probably going to find F.P.C. costs slightly lower and private costs slightly greater than shown. The expenditures of all concerned are close to $37 million on Federal Power Commission regulation in a single year.

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[1] The minimum field price costs of $30 million include $10 million resulting from certification delay (assuming that the delay has been cut to a minimum of very few months), $18 million from area rate proceedings, and $2 million in other rate reviews and cases.

Table 1: The Annual Costs of Regulation

Activity	Federal Power Commission Costs	Company Costs	
	estimate (millions of $)	estimate	range (millions of $
ctric power price regulation	1.6	1.6	0.2 to
ctric power systems evaluation	1.3	1.9	
field price regulation	3.1	30.0	30.0 to
pipeline price and systems regulation	3.5	2.5	
eral Commission administration	1.1		
al Annual Costs	10.6	36.0	34.6 to

The Benefits from Regulation by the Federal Power Commission

The standards for setting maximum prices have been rather general, given the mandates of Congress and the courts, and those for regulating quality have been ad hoc by nature. Changes in emphasis on portions of statutory language can lead to significant changes in regulatory procedures and reviews. Given such discretion, what has been the behavior of the Commission? With a well-established organization and peremptory power to demand resources, what has been decided by the Commissioners, and what have been the effects of the decisions on the economy in general?

The Commission itself attempts to show the economic effects of regulation in the Federal Power Commission Annual Report. The 1968 Report announced that during the last fiscal year "reductions in wholesale rates of electric power moving in interstate commerce and subject to the Commission's jurisdiction amounted to $8,860,595; the largest total for a single year in the Commission's history. . . . While many rate filings were submitted by the utilities on their own initiative, nearly 70 per cent of the total dollars of rate decreases were the result of Commission action. . ." (The Federal Power Commission Annual Report, 1968, page 19). The cases against proposed price increases included some decided in the Commission's favor, or withdrawn by the companies. The dollar amounts that would have been paid by the consumers in the absence of these cases are counted among the gains from power regulation.

There were much greater gains claimed from imposing ceiling prices on field supplies of natural gas. The interim ceiling prices

set in 1961 were lower than the unregulated prices on sales of new reserves in 1960. The resulting total "savings" in purchase costs of pipeline buyers were consumer benefits attributed to regulation. The Commission's assessment of the benefits was given in the 1964 Annual Report as $434 million,[1] the amount collected by the producing companies subject to refund after the regulatory review was complete.[2]

The Federal Power Commission also saw benefits from reduced gas consumer prices as a result of gas pipeline rate investigations. The Commission states that, "Of ten major proposals to increase [pipeline] rates by a total of $63,380,200 annually. . . One proposal, involving $2,687,100 annually was rejected and two involving $95,400 annually were accepted without suspension. . ." (The Federal Power Commission Annual Report, Fiscal Year 1968, page 59). Another $13 million of rate increases were withdrawn by the companies in the face of Commission opposition, and there were $13.9 million in rate reductions required of the pipelines after Federal Power Commission rate filing reviews. The Commission actions in the gas pipeline industry resulted in $28 million of rate reductions which were eventually to become benefits to the individual consumers of natural gas.

This accounting results in greater estimated benefits to the economy than economic analysis allows. The rate reductions are realized

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[1] Cf. the Federal Power Commission Annual Report (1964), page 140.

[2] The Commission did not state directly that the receipts subject to refund were consumer benefits. Two implicit statements are needed to make the argument: (1) these receipts $(\Delta P)Q$ for volumes Q at price reduction ΔP are benefits to pipelines (2) the pipelines pass them on to the consumer in full.

by some consumers as increases of real income, but other consumers in their roles as stockholders of gas and electricity companies experience income losses from dividend reductions. The income gains of the first group and the losses of the second, shown as the area "A" equal to $(P_1-P_2)Q_1$ in Figure 1, result in only partial net economy-wide gains. The net gains depend entirely on the extent to which the income distribution after the rate reduction is more "socially acceptable" than the distribution before the reduction.[1] Only the "quantity-quality" increases generated by regulation are net economy-wide gains. The consumption generated by the reduction in price can result in net gains to both groups, given that the area "B" under the demand function is not an income loss of the producers and is a gain of the consumers.[2] The consumption generated by increased demands under regulation, shown as area "C", also result in net gains for the economy. But neither areas "B" and "C" can be said to be a large part of the Federal Power Commission's dollar savings from regulation.

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[1] There is no a priori reason to favor the consumer's income over that of stockholders, because there is no theory establishing the general equity of such redistribution. In fact, there is no theory implying that such redistribution makes income more equal; rather this is an empirical matter.

[2] There are technical assumptions required to make this statement hold, which imply that the effects can be described by movements along this demand curve and not from shifts of this curve. Cf. M. Friedman, the "Marshallian Demand Curve", Journal of Political Economy, December 1949. But also the area "B" has to be net of costs of supplying the additional consumption, even though the "costs of service" do not show whether this is the case.

Not only economic analysis but also conditions in gas and electricity markets may not allow so tolerant an interpretation of the results from regulation. Price reductions might have taken place in the absence of regulation as a result of cost reductions. After all, monopolists are expected to reduce prices when scale effects are predominant, or factor costs decline as a result of technical progress, or when there is substantial entry of other companies on geographical or product fringes of markets long held on an exclusive basis. All these conditions have been present in these two industries. There is evidence of large scale economies in systems, and of substantial recent cost reductions from fuel price reductions in electricity.[1] Companies in each industry face competition from those in the other and from coal and oil in industrial markets for energy. The company may be more than willing to reduce rates for reasons of profit and credit the results to vigorous regulation by the Commission.

Economic Benefits from Electric Power Regulation

The Federal Power Commission announced $8.9 million of electricity price reductions in the 1967-1968 fiscal year, but claimed that only 70 per cent of this amount resulted from Commission initiatives, so

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[1] Cf. P. MacAvoy and J. Sloss, Regulation of Transport Innovation: Unit Trainloads of Coal to the Eastern Seaboard (Random House, 1966) and P. MacAvoy, Economic Strategy for Developing Nuclear Breeder Reactors, Appendices A and C (M.I.T. Press, 1969).

that the benefits from regulation were $6.2 million in that year. This is a first and potentially interesting indication of the size of the price reduction on all established sales (equal to area "A" in Figure 1). But an additional step has to be taken to make it useful for assessing economy-wide gains. These gains of consumers have to be measured against the losses of other consumers receiving income from the electricity generating companies.

The calculation proceeds by groups of consumers. The purchasers of electricity that are industrial or commercial enterprises experiencing price reductions surely gain no more than the electricity producers lose. Price reductions are passed on in dividends or lower final product prices. The recipient companies' stockholders gain the dividends that the electricity company stockholders lose so that there is no net gain, unless there is some particular condition such as the recipients being "poorer" than the electricity company equity holders. The final consumers of products from companies with lower electricity costs of course could capture all the benefits. But this has not been very likely -- the four largest gas and electricity consuming industries in the 1960's were so highly concentrated that individual recipient companies certainly need not have passed on small cost reductions in order to survive.[1] It cannot be assumed that

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[1] According to the 1962 Census of Manufacturers, the four largest consuming industries were primary metals, chemicals, petroleum, and stone-clay-glass. The four digit concentration ratios in these industries were 56.1, 49.3, 36.7, 37.1 per cent respectively, according to Concentration Ratios in Manufacturing Industry (Washington, 1963); they are all higher than the all-industries average of 32 per cent.

an appreciable proportion of the $6.2 million accrues to final consumers through producing companies experiencing lower energy costs; it is expected here in practice that there is no net gain from income transfer on 55 per cent of the dollar rate reductions.[1]

The final consumers of electricity in contrast may gain some part of the amount that the owners of the electrical companies lose. There are many different opinions on how much a dollar is worth when given to person X, after it has been taken from person Y. Here the point of view is that the government should decide, and it indicates value by the amount that consumer X can keep after taxes (the remaining portion of the dollar being taken in taxes for better political use elsewhere).

The governments of this country tax consumers on income received in money wages and salaries, but not income received in price reductions on consumption goods. It would appear that the rate of political preference for price reductions is very high, and any amount passed directly from producer to consumer should be treated as completely gained. The preference for dividend increases, as revealed by tax treatment of these incomes, is very low; dividends are taxed at the corporate rate of 50 per cent before they are distributed,[2] and then a

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[1] In a typical year in the late 1960's, commercial and industrial sales accounted for 55 per cent of total revenues from ultimate or final service each year. Cf. F.P.C. Statistics of Electric Utilities.

[2] Only so long as companies cannot take advantage of exceptions such as depletion or depreciation allowances. These exceptions of course reduce the real rate below the formal 50 per cent rate.

second time at the applicable personal income tax rate. It would appear that only the income left after double taxation is lost by a rate reduction.

As a result, reducing dividend incomes of electricity company stockholders by $1.00 transfers [.50 (1-t)] ($1.00) of "politically approved" income to consumers.[1] With an average tax rate "t" on dividend receivers' own personal incomes equal to 40 per cent,[2] the transfer to consumers results in gains of 30¢ on the dollar. The other 70¢ on the dollar is received by the consumer, but it comes from taxes foregone and the electricity consumer has no special claim on that over recipients in government programs. The amended estimate of net gains on direct consumer sales in the $6.2 million is $0.8 million.[3]

The economic gains are associated, however, with the quantity increases generated by the rate reductions (shown as area "B" in Figure 1). The maximum estimate of this surplus is the area $(\Delta P \cdot \Delta Q)/2$ for the regulation-induced price reduction ΔP and the resulting increase ΔQ in quantity demanded. The Commission reports do not

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[1] That is, the direct transfer from net income of dividend receiver to net income of rate payer is $1.00 minus taxes, or
($1.00) - [(1.00).50 - (1.00)(.50)t] = .50(1-t)(1.00).

[2] The average income of all stockholders is estimated to be $108,000 per year. This estimate is from weighting incomes shown in 1967 Statistics of Income (Individual Returns) by the amount of dividends received. Cf. U.S. Department of the Treasury Statistics of Income 1967. The averag aggregate tax rate on this income, given personal deductions allowed in a four person family, cannot exceed 40 per cent. Then the implied rate of taxation on $1.00 of pre-tax dividend income of an electric generating company is 50 per cent on corporate tax and 20 per cent on personal tax (or 40 per cent on the remaining after-corporate-tax 50 per cent).

[3] This is 30 per cent of the 45 per cent of total sales accounted for by home consumers.

estimate the rate reductions, nor their effects on quantity demanded. They can be roughly approximated in percentage terms.

The Commission tells us that rate reductions in the two most important cases were 5 per cent and 9 per cent of total receipts, so that the average of $(\Delta P)(Q)/(PQ)$ can be assumed to be 7 per cent. Other sources provide indications of demand elasticity $P\Delta Q/Q\Delta P$. Demand elasticity estimates in detailed econometric studies range from -.2 in the high income Northeast states to -.7 in the Southern states for home consumption. Industrial demand studies indicate elasticities of -1.0 in ten large using industries.[1] A less exact but more current overall estimate of elasticity is -1.2.[2] The two together can be used to find area "B". Multiplying this last elasticity estimate by the percentage reduction provides an estimate of ΔQ; this along with the Commission's announced reductions of $6.2 million provides an estimate of $(\Delta P)(\Delta Q)/2$ of $260,000.[3] The quantity-increase

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1 F. M. Fisher and C. Kaysen, A Study in Econometrics: the Demand for Electricity in the United States (North Holland, 1962), pp. 42, 50, 135. These are averages over states and industries, roughly in accordance with the amount of electricity consumed.

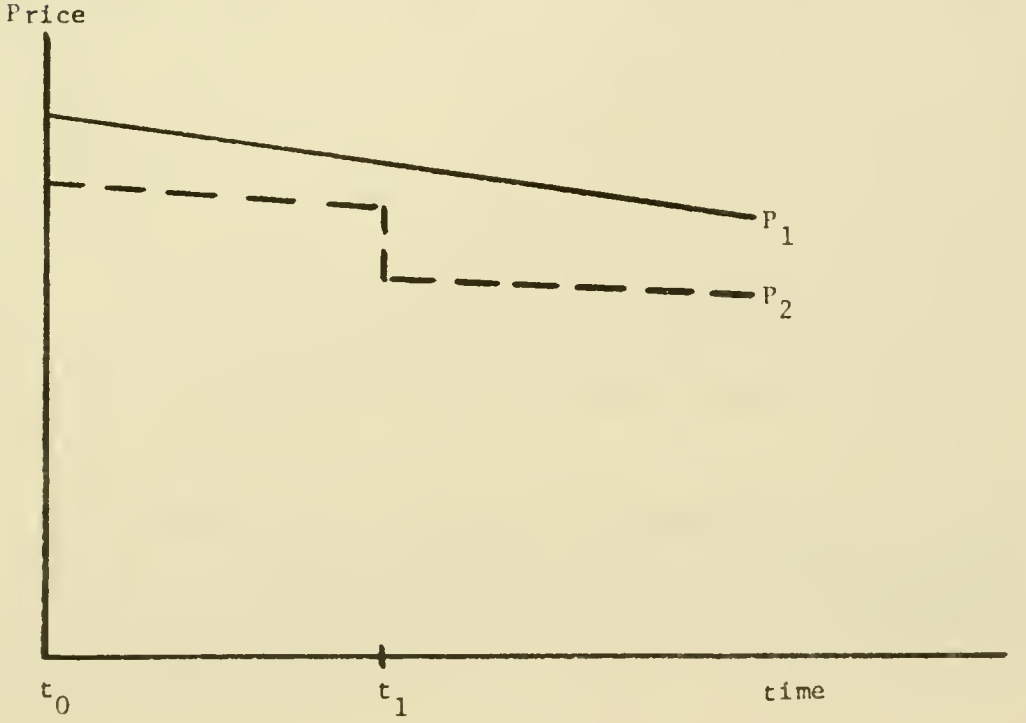
2 P. W. MacAvoy, Economic Strategy for Developing Nuclear Breeder Reactors (M.I.T. Press, 1969), Appendix C, "Documentation of Forecasts". The elasticity is for price of electricity effects on the demand for generating capacity, and this is a long run elasticity.

3 The calculation procedure is straightforward. There are three pieces of information: (a), $(\Delta P)(Q) = -(6.2)(10^6)$; (b), $(\Delta P)Q/PQ = -.07$; and (c), $P\Delta Q = -1.2Q\Delta P$ assuming that the elasticity of final demand is -1.2. From (b) and (c), $-P\Delta Q/PQ = -.084$ or $Q = \Delta Q/.084$. Substituting this expression for Q in (a), then $(\Delta P)(\Delta Q) = -(6.2)(10^6)(.084)$ and 1/2 of this amount constitutes a first estimate of consumers' surplus.

benefits from one year's electricity regulation are not much more than one quarter million dollars.

The total annual benefits in "A" and "B" should last at least five years, and it may well be ten years before changes in market structure and demand conditions vitiate the one year's particular events in regulatory history. Accounting for this lag effect, the total benefits from the surveillance and rate review activities during a single year are equal at most to the present value of ten years of price reduction. An example is shown in Figure 2: at time t_0, a review of rates has been completed and has resulted in prices being reduced from P_1 to P_2; both P_1 and P_2 fall after that time as a result of greater than economy-wide productivity increases, but P_2 falls slower than P_1 until at time t_1 much of the effect of the rate review has been eroded; at that time a new review takes place.

Figure 2



The example raises the central questions on how rapidly the two price lines merge, and when the next review takes place. The answers can only be surmised at this stage of our knowledge of F.P.C. activities; a conservative response -- making for a maximum estimate of benefits -- is that it takes ten years for all effects of a review to be realized, but the effects decline at the rate of 15 per cent per year.[1] The present value of income benefits of type "A" is $4.0 million, and of quantity type "B" is $1.3 million.

These amounts must be maximum net benefits. The price reductions required after any one Commission review are usually small, and the costs of litigation not so small, so that the temptation of the company is to concede the Commission-ordered reduction even when it takes some rates below costs.

This is seen in the most recent formal case review of an electric power company's rate schedule before the Commission: the Northern States Power Company (in Docket E-7140) conceded $254,468 of rate reductions based on 1963 schedules after an extensive cost analysis by the company showed "cost of service" of $4.653 million and a parallel analysis by the Commission staff showed "costs" of $3.486 million. There were no standards by which the difference could be resolved, since they "reflect differences in cost assignment and allocation procedures" (34 FPC 883, at 884). Without substantive procedures, the

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[1] The fifteen per cent discount rate is somewhat high, but deliberately so. There are two reasons: this is a realistic estimate of the rate of return in the private sector on resources drawn off for the regulatory process, and this accounts for the possibility of very high rates of decay in the gap between P_1 and P_2 when the economy changes rapidly.

company could only assess its chances of winning in Court in a random process but after extensive additional costs of litigation. It chose to concede "without prejudice to its contentions" and the Federal Power Commission found this "an acceptable compromise of contested issues involving numerous judgmental factors" (Ibid.). The company's choice was between the costs of litigation, or revenue losses in price reduction, whichever was less, but without regard to whether the second resulted in rates below production costs. The clear possibility exists that these reductions took rates below production costs, with consequent loss of some part of the quantity gains in area "B".

There are two more reasons why this is a maximum estimate of the gains from electricity rate regulation. First, some part of the "Commission-induced" reductions would have occurred anyway. One company president said, in response to requests for estimates of the private costs of regulation, "in the early 1960's the Federal Power Commission for the first time asserted jurisdiction over the sales by electric utility companies to local distribution systems. . . . Although the Commission's jurisdiction had been defined by statute in 1935, the Commission under Chairmen Swidler and White greatly extended the concept of what constituted an interstate sale. In most states these wholesale rates had been regulated by the state commissions for many years. . . . Many state commissions still assert duplicate jurisdiction over such sales. . . ."[1] With duplicate regulation, some rate reductions occur as a result of the activities of state commissions.

Last of all, quite plausible conditions in electricity markets implying lower benefits could hold rather than those assumed above. The percentage price reduction, and the elasticity of consumers' demand with respect to that reduction, could well have been much lower than the estimates used here. In fact, price reductions below five per cent, with a value of elasticity of -.2 (as found by Kaysen and Fisher for home consumers in high income states) make the estimated consumers' surplus "B" from regulation so close to zero that it might as well not be considered at all. A more cautious view of benefits restricts the estimated amount to that for area "A", for a five year period before the "decay" of the difference between regulated and unregulated prices, and this amounts to only $2.7 million from one year's regulation.

Economic Benefits from Gas Field Price Regulation

The Federal Power Commission's setting of interim natural gas field prices was not enough of an "act of regulation" by itself to show economic benefits. Since these interim prices are still being reviewed in the "area rate" proceedings, regulatory effects have not yet been realized. But timing alone is not the only reason for lack of results; in fact, regulatory gains are not going to be realized in any straightforward manner whenever the "area rates" are determined. The effects of area rates include hard-to-detect gains by some consumers and losses by other consumers as well as producers.

The proposed area rates freeze prices at the level attained on the larger "packages" of field reserves in the late 1950's to very

early 1960's. Those prices "cleared the market" given the demand and supply conditions of that time. Since then market conditions have not been the same -- population and income increases, changes in tastes in favor of cleaner fuels, have increased demands by substantial magnitudes. The question is whether there has been additional supply forthcoming to satisfy the greater demands for new contract reserves. Under normal conditions of gas discovery, with effective competition in field markets,[1] the imposition of 1960 price ceilings could only guarantee that the quantity supplied would reflect 1960 conditions. Then 1970 (increased) demand and 1960 supply would imply excess demand. But gas discovery and development varies greatly from year to year without close and direct relation to prices, so that supply could have increased more or less than normal.

Excess demand where it occurs results in reduced benefits to consumers having to do without some part of the service they seek at the going prices. The lower regulated prices provide gains for those established consumers not affected by service restriction. But the lower prices also reduce incomes of those receiving dividends from the gas producing companies. The gains have to be compared with the losses.

These gains and losses are illustrated in Figure 3, for a regional market containing new reserves of gas for sale under long term contract

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[1] The effectiveness of competition here is one of the most researched topics in industrial economics in the last few years; there is tacit agreement even in the area rate cases to center analytical attention on the competitive model. Cf. review and citations in E. Kitch, "Regulation of the Field Market for Natural Gas", The Journal of Law and Economics, October, 1969.

to pipelines. The demand for reserves of gas to serve new industrial and home consumers is shown as the curve D, with additional reserves sought by pipelines at lower prices per thousand cubic feet. The supply of these reserves -- found in exploration for gas and oil, and developed by additional drilling beyond the exploratory well -- is shown by the curve marked SS. The market clears at price P cents per thousand cubic feet of newly contracted reserves and quantity Q trillion cubic feet of new reserves sold to pipelines per annum. The Commission, however, sets area rates that average only P' so that the quantity demanded is Q" while the quantity supplied is Q'. The demand curve D' shows the amounts sought only for those not rationed. With these restricted demands, the smallest possible loss to excluded consumers is the shaded area B* in the diagram,[1] since this is the graphical representation of the net amount over costs that the (unsatisfied) consumers would pay to receive the "lost" output Q - Q'. The greatest possible loss is the whole area between the two curves D and D' above the supply curve; this would occur if rational consumers are excluded outright and all of the demands of other consumers are met.[2] Either of the loss estimates have to be balanced against

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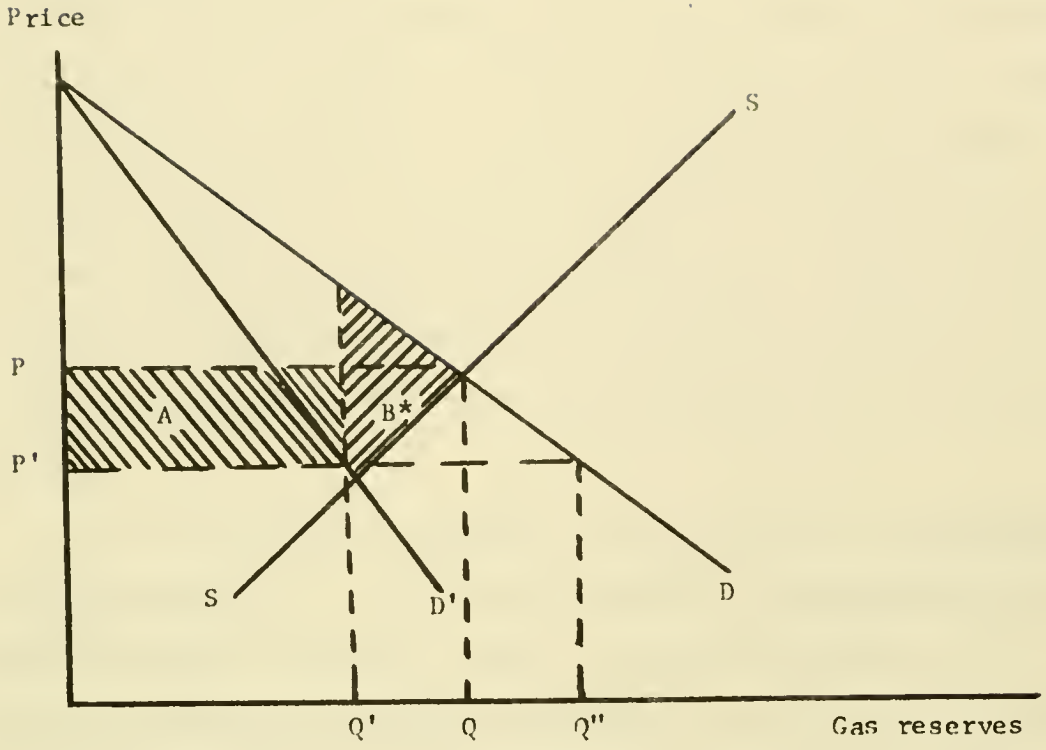
[1] Area B* is not equal to area B in Figure 1, because it includes both triangles above and below the price line P. The triangle below the price line, equal to producer's surplus, was excluded in the first diagram. This was not for analytical reasons but because there is no measure at this point in research for the difference between marginal costs (in that case) and "costs of service" (equal to average price in that case). At the least, the companies have not announced their gains from the quantity or sales increases initiated by regulation (if any).

[2] This is the case in which pipeline extensions to certain locations are simply not allowed because "reserves are insufficient".

Figure 3



the potential gains to those receiving all they want. These gains are that "politically acceptable" part of the income transfer shown as area A; they are only part because some of the transfer is to other industries besides the gas producing industry, and some is foregone tax payments given to consumers with "socially-less-desirable" incomes. We shall attempt to estimate the losses from excess demand and this income gain as well.

The losses of unsatisfied gas consumers in recent years have not been directly observable. Even if they were great, the losers themselves have not been aware of their circumstances because the pipelines have been providing them gas that they will not be able to

provide in the future. Faced with new contract volumes less than the amounts necessary to make deliveries to new customers over the next twenty years, the pipelines provide gas to all new sources of demand for a shorter time period. The losses to customers are from the shortened commitment -- from gas not available to continue delivery in the eighteenth, nineteenth, and twentieth years. Most of them do not react to these losses when delivery begins; but they can still be detected indirectly in the supply-demand behavior of the gas field markets.

Here the losses are assessed by first finding (1) the magnitude of excess demand (Q" - Q'), then estimating (2) the area under the demand function D between Q' and Q", and last subtracting out (3) the area under the supply curve SS between Q' and Q". This procedure leaves the shaded area B* in Figure 3 as a residual. So as not to exaggerate the losses, this residual is made as small as seems reasonable.

(1) Excess demand (Q" - Q') depends on the amount of new reserves needed to meet commitments to new buyers and on the amount needed to replace depleted reserves for established buyers. The Federal Power Commission considers reserve demand of pipelines to be twenty times the volume of initial delivery to a final buyer; that is, demands for reserves are based on "the assumption that each new market commitment is backed by a twenty year supply."[1] To make this commitment on new sales to industrial and retail utility consumers, new reserves should be purchased by the pipelines equal to twenty times the amount of any

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[1] Federal Power Commission, A Staff Report on National Gas Supply and Demand (Bureau of Natural Gas, Washington, D.C., September 1969) p. 18.

additional delivery to final consumers; this "commitment to expanded delivery" is derived as demand D(1) in column (3) of Table 2 by multiplying year-to-year production changes by twenty. To maintain commitments to established buyers, the same rule would apply on replacement reserves. Each year, approximately 5 per cent of deliveries into pipelines deplete old reserve commitments of the gas producers, and the continuation of service to final consumers requires this replacement with new commitments of 20 year reserves with the same annual rate of production. Demand D(2) for commitments to these final consumers equal 5 per cent of "base year" (1962) deliveries times twenty, or are equal to the actual levels of delivery in that year.[1] These demands are shown in column (4) of Table 2. The two demands together have been for more reserves than those likely to have been supplied from newly developed gas acreage by an amount of 13 trillion cubic feet per year in the period 1962-1967.[2]

This amount can be called "excess demand" only if two conditions hold. First, there should have been no excess holding of reserves from earlier years, to be put against the deficit in the 1962-1967 period. Second, there should have been continued demands of established buyers for the gas listed in "replacement reserves" even when there were substantial price increases. The first would seem to have been the

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[1] If production on old contracts equals X, an amount that is 5 per cent of committed reserves R in every case, then new reserves to maintain the rule-of-thumb should be $\Delta R = .05R = X$.

[2] The average difference between (a) reserves in column (2) and (b) "commitments" in column (3) plus column (4), was 12.7 trillion cubic feet per year.

Table 2: Estimates of Supply and Demand for Reserves in the United States

	Supply	Demand	
		D(1)	D(2)
Year	Additions to Reserves (trillions of cubic feet)	Reserves Required for Additional Production (trillions of cubic feet)	Reserves Required to Replace Depleted 1962 Reserves (trillions of cubic feet)
(1)	(2)	(3)	(4)
1962	19.5	18.2	13.6
1963	18.2	16.0	13.6
1964	20.2	18.2	13.6
1965	21.3	25.8	13.6
1966	20.2	17.8	13.6
1967	21.8	19.9	13.6
1968	13.6		

Note: Column (3) consists of additions to production in the year following that year listed in column (1), multiplied by 20. For example, the net change in national production of gas in 1963 was 909 billion cubic feet, so that required reserves in 1962 equal (909) (20) or 18.2 trillion cubic feet.

Source: American Gas Association Reserves of Crude Oil and Natural Gas in the United States, volume 23, May 1968.

the case; prices were generally increasing in the five years previous,[1] and there were deficits in reserves in each of these years averaging to 4.0 trillion cubic feet per annum.[2] But the second condition may not have been realized. The price increases experienced in the 1950-1960 period should have been sufficient to induce many of the gas users in the primary metals industries to switch to residual fuels when long-term contracts under the old prices expired; indeed, the volume of use of gas in that industry declined from 3.8 trillion cubic feet in 1954 to 0.9 trillion cubic feet in 1962.[3] This was extra marginal replacement, and there were other industrial buyers in disadvantageous locations or with low-priced alternative fuel suppliers who were in the same category.[4] If most of replacement demand actually did disappear at prices close to the F.P.C.'s ceiling prices, then there was no excess demand. As one alternative plausible state of the industry, it is assumed here that most of the replacement demand shown in Table 2 existed and thus that excess demand has been 13 trillion cubic feet per annum. As another alternative, less plausible state of this industry, it is assumed that there was very little replacement demand and thus that there was no excess demand.

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1 Cf. P. MacAvoy Price Formation in Natural Gas Fields (Yale University Press, 1962) Chapters 5, 6, 7.

2 The 1955-1961 total deficit of "additions to reserves" under "demand for reserves" is estimated as 28.1 trillion cubic feet as calculated from American Gas Association statistics as noted in Table 2.

3 Cf. the Census of Manufacturers, op. cit.

4 In fact, the all-industries consumption of natural gas shown in the Census of Manufacturers declined from 5.9 trillion cu.ft. in 1954 to 4.3 trillion cu.ft. in 1962. This partial census alone implies that (1.6 trillion)(20) = 32 trillion cu.ft. of demand in that period was elimi

(2) The area under the demand function over the range of excess demand can be approximated if estimates are available of the amount of excess demand (13 trillion cubic feet to zero trillion cubic feet), and the amount of "cleared" demand (approximately 19 trillion cubic feet of new reserves on average as shown in column (2) of Table 2). Also, there has to be an estimate of the elasticity of demand for additional reserves.[1] In fact, there are many demand studies of final users of gas, the most complete and analytically convincing being those of Pietro Balestra.[2] His studies of incremental demands of home consumers provide an indication of the demands for new reserves to be used to provide more home consumption; they show a price elasticity of -1.3 in the last year of the study (1962).[3] Demands of industrial users, accounting for almost 65 per cent of the total volume of production at the present time,[4] have not been analyzed in a dynamic model; but studies of industrial buyers at different locations with varying gas prices show price elasticities in consumption exceeding -2.7.[5] The weighted average of home and industrial

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[1] The area under the demand curve between Q' and Q", and above the existing regulated price P', is approximated by $\Delta P \Delta Q/2$. Here $\Delta Q = Q'' - Q'$ and $\Delta P = P'\Delta Q/Qe_D$ with e_D equal to the elasticity of demand for new reserves. Then $\Delta P \Delta Q/2 = P'(\Delta Q)^2/2Q''e_D$.

[2] P. Balestra The Demand for National Gas in the United States, Amsterdam, the North Holland Publishing Company (1967).

[3] op. cit., section 4. 3. 7., pp. 95-99.

[4] Cf. The Federal Power Commission Annual Report 1968, p. 45.

[5] Cf. the Federal Power Commission's econometric model, as in Testimony of J. Harvey Edmonston, Federal Power Commission Docket AR61-2, "South Louisiana Area Rate Proceeding". The model contained in this testimony has been severely criticized because of feedback from demand to supply that always "clears the market" at the demand-determined price. But the industrial demand sub-system has not been open to such criticism; indeed, it is

elasticities is close to -2.2.[1] Given this estimate, the gross loss of consumers' surplus $\Delta P \Delta Q/2$ from excess demand is estimated at $\Delta P \Delta Q/2 = P'(\Delta Q)^2/2Q''e_D = \$204$ million.[2]

(3) The net loss is equal to this gross loss on sales to consumers not receiving service, minus the costs that would have been incurred on the additional service. These costs are shown as the area under the supply curve over the same range of excess demand of 13 trillion cubic feet. To make calculations of this area, all that are needed, in addition to the estimates above, are the elasticity of the supply function e_s and the market clearing quantity Q at the unregulated price. To find the elasticity of supply, we turn again to the F.P.C. econometric model of gas prices. There we find that reserves {$R = 3.5 + .257Y.f$} where Y is the number of discovery wells and f is footage drilled; removing the defective feedback from production (demand) to reserves (supply) in Y results in a direct price-supply relationship[3] with an elasticity close to +.239.[4]

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[1] The weighted average follows from assuming that household and commercial demand both have the same elasticity and comprise 35% of the total new demand for reserves. The industrial demand includes electric power and gas transmission demand and comprises 65% of total consumption. Consumption and reserve demand are assumed to be the same in all cases - an assumption that holds only if there is no decline in industrial consumption with rising prices, as above. Cf. the F.P.C. Annual Report, op. cit., p. 45.

[2] Here P' the unregulated price is 17 cents per m.c.f., ΔQ or excess demand is 13 trillion cubic feet, Q'' the total of realized and excess demand is 32 trillion cubic feet, and e_D is -2.2.

[3] Cf. the testimony of P.H. Cootner in rebuttal of J. Harvey Edmonston, Docket AR61-2, "South Louisiana Area Rate Proceeding". Professor Cootner recalculates the equation after removing this feedback condition, and the recalculation is used here.

[4] In shortened form $Y = \alpha P^{\beta}$, where α stands for a series of variables unrelated to price, and $R = 3.5 + .257 (\alpha P^{\beta}).f$. Then $e_s = P\partial R/R\partial P =$

The market clearing quantity Q can be found indirectly. The change in price P to bring forth supply is equal to the change in price required to reduce demand to the market clearing level, so that $\Delta P/P = (Q-Q')/Q' \cdot 1/e_s = -(Q''-Q)/Q'' \cdot 1/e_D$. This equation can be solved for Q. For the indicators available here, the estimated market clearing quantity Q is close to 20 trillion cubic feet in a "typical" year in the late 1960's -- an amount very close to the 19 trillion cubic feet found on average under regulation.

All the estimates have been made that are required to measure the "shaded area" of losses to unsatisfied consumers in Figure 3. The area under the supply curve is approximately $18 million, a small amount reflecting the low elasticity of demand;[1] the area of excess demand below price P is $174 million, reflecting the high elasticity of demand.[2] The losses to consumers from excess demand are $204-192 million or $12 million per year. This is the greatest likely dollar equivalent to the shaded area in Figure 3. The smallest likely loss is zero, as a result of approximate equality of Q', Q and Q'' from regulated prices clearing the market at the approximate unregulated level.

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[1] This area is found by solving $\Delta P\Delta Q/2 = P'(Q'-Q)/2Q'e_s$ with the values in the text.

[2] This area is equal to $\Delta P\Delta Q/2 = P'(Q''-Q)^2/2Q''e_D$ for regulated price P', the total of realized and excess demand Q'' and market clearing demand without regulation Q. This area is not consumers' loss because it is excess demand that would not be satisfied in an unregulated market because costs are greater than unregulated prices for these amounts.

No one knows how long such annual losses will continue to be part of the regulatory results in setting gas field prices. At one extreme, they could continue for the lifetime of an area rate schedule set this year, with the schedule lifetime extending to ten years. At the other extreme, 1970 would be the last year of excess demand if the Commission moved rapidly to raise the interim rate ceilings in the pending cases and to revise upwards those in the Permian Basin decision. The area rate proceedings themselves have taken or will take more than five years to complete, so that the costs of litigation in "one year's regulation" have been repeated five times over; for comparability of one year's costs of regulation with benefits from that one year's activities, the one to ten years of benefits have to be divided by five. The negative benefits for unsatisfied consumers range from zero to $12 million.[1]

The income gains of established consumers. Some consumers have been able to obtain the amounts of gas they demanded, and they have gained real income from the price reductions imposed by the Federal Power Commission. Their benefits are not likely to be equal to the amounts now collected by the producers "subject to refund" after the area rate proceedings are complete, because these amounts imply much

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[1] The difference between this calculation problem and that for benefits from electricity regulation follows from the fact that the area rate cases are not complete, while those analyzed for benefits from electricity regulation have been completed. The assumption leading to the maximum loss of $12 million is that the area rate reviews will be complete after five years and that ten years of present value of negative benefits will follow. The "one year's" benefits from regulation are $\frac{1}{5}\sum_{1}^{10} B_t/(1+r)^t$ for 10 years at r = 15%. In this calculation this equals $B_1(1.0037)$ where B_1=$12 million.

lower ceiling prices than those likely to be put into effect. In fact, the ceiling prices set in the Permian Basin area rate proceeding were equal to those on non-regulated transactions in the early 1960's; as Commissioner O'Connor states in his separate opinion in that proceeding: "From the record in this proceeding, for the period with which we are concerned, the overwhelming volumes of gas well gas are sold under new contracts at the weighted average price of 16.5 cents (the area rate)".[1] As a result, most "refundable collections" on Permian Basin production will not be refunded and similar findings on the ceiling rates elsewhere will have similar results.

The consumers' income gains have been made on contracts signed for production of reserves after 1965. The amount of the gains depends on the prices that would have been set by purchasers in the absence of regulation -- on price P rather than P' in Figure 2. If the circumstances were those of no excess demand, the gains were zero because prices P and P' were approximately the same. If the circumstances were those of excess demand in keeping with $12 million losses to unsatisfied consumers, the market price P would have been some two cents higher than the regulated price. The difference (P-P') on the completed sales Q' were the maximum income redistribution gains for "satisfied" consumers.

The consumers' gains here were producers' and government tax losses. Since the case can be made for net gains only on sales to

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[1] Area Rate Proceeding No. AR61-1, 34 F.P.C. 159, at 265. Similar findings apply to "old" gas production.

home consumers, they were limited to that part of new reserve sales made to interstate pipelines for resale to home consumers.[1] In each of the last few years, approximately 18 trillion cubic feet of new reserves were dedicated to interstate pipelines under the rate ceilings, and perhaps 35 per cent of this amount was for delivery to home consumers.[2] Then the gains were limited to two cents per thousand cubic feet on 6.3 trillion cubic feet, or $126 million each year.[3] The losses in government tax receipts were 50 per cent of this price reduction, because the petroleum companies would have paid income taxes in excess of the depletion allowances on the same amount as their income and then the dividend receivers would have paid income taxes on it once again. The net income redistribution gains -- counting the non-tax losses of dividend receivers not at all --

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[1] The argument here is the same as for income transfers from lower electricity prices: all industrial producers or consumers are in the same income class, but home consumers are in a lower income class; the value of transfer to the lower income class is shown by the marginal tax treatment of a dollar there rather than to the gas company's dividend recipients.

[2] This percentage assumes that residential and commercial sales are all "home sales". Cf. the Annual Report of the Federal Power Commission, statistics on gas reserves and sales for resale to home consumers in the 1966, 1967, 1968 issues.

[3] As in the case of income transfers from reduced electricity prices, it is assumed that consumers gain (.50-t) dollars for every dollar at reduced dividend income, and that t=.20 marginal reduced tax rate on the recipient. Here it has been assumed that (.20+t) holds for depletion revenues, and t=.30 because of higher incomes earned from the lower company taxes.

have been limited to $63 million at a maximum (if there has been a gas shortage) and zero at a minimum (no shortage).

The problem with these income gains is that they have been realized on the basis of only interim ceiling prices, and these prices may be lower than the final area prices set in the formal rate proceedings. Additional rate reviews are likely to result in smaller price reductions in face of pressures from excess demand. The chance of higher prices is great enough that future gains must be discounted not only at the 15 per cent rate, but must be assumed to be limited to ten years. Also, five years are required to complete any of these proceedings, so that the total gains for established consumers have present value of approximately $63 million.[1]

The net benefits to consumers as a group could have been equal to the gains of the advantaged of $63 million minus the losses of the deprived of $12 million. At least such an estimate is plausible, if not convincing. As likely is the possibility that there was no excess demand, so that gains and losses were both zero.

The Economic Benefits from Natural Gas Pipeline Regulation

The Federal Power Commission's proceedings on applications by the interstate gas pipelines had the effect of reducing some prices, and limiting entry in some instances. The amounts of the price

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[1] This calculation assumes that it will take five years of regulatory expenditure to attain ten years of gains of $63 million per annum. Both gains and costs occur over roughly the same time period -- although the gains occur mostly at a later date. As a first approximation, then, costs for one year of regulation times five equal total regulatory expense, and one year's benefits of $63 million times ten equal total benefits. For convenience, neither costs nor benefits are given in total value terms here but rather in terms of one year's results. Benefits

reductions may have been greater than those associated with regulation of electric power prices or gas field prices. The savings from prohibiting entry are unknown.

The Federal Power Commission disallowed $2.7 million of price increases proposed during the 1968 fiscal year, as well as $12.0 million of previously-proposed increases.[1] They were responsible in some part for $13.9 million of rate reductions the last year and $50.9 million the year before, "which were, in large part, flowthrough of supplier refunds and rate reductions."[2]

All of these reductions might be credited to the Commission -- none of them might have taken place in the absence of regulatory price reviews, even though it could have been profitable for the firms to reduce prices by the announced amounts given cost reductions from increased advantages of scale or other aspects of technical progress. But even given such a view, credit can be taken in pipeline regulation only for the former reductions since the latter already has been attributed to field price regulation; and this credit is for reductions of 10% under unregulated prices at the most, so that the net gains from more consumption $\Delta P \Delta Q/2$ could have equalled no more than $2 million.[3]

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[1] Cf. the Federal Power Commission Annual Report (Fiscal Year 1968), p. 59.

[2] Op. cit., p. 60.

[3] This calculation proceeds in exactly the same fashion as those for finding consumers' surplus from electricity rate reductions. Given that $(\Delta P)(Q) = \$14.69$ million, $\Delta P/P = 10$ per cent, and the elasticity of demand is -1.28 as shown by the econometric demand relations for gas described above, then $\Delta P \Delta Q/2 = (-.10P)(-1.28 \Delta P/P) = (-.10)(-1.28 \Delta P.Q) = \$1.88$ million.

The accompanying gains from distributing stockholders' income to consumers were limited by the small consumer participation in final demand; with 35 per cent of final demand attributable to home consumers and 30 per cent of that equal to the indirect income gains from redistribution to "poor" consumers from "rich" stockholders, the net benefits in one year are estimated at $1.5 million.[1] At most, ten years of gains could result from one year's regulation, so that the present value of the year's activities in setting rates for natural gas pipeline companies would be $9.4 million for "quantity-increasing" regulation and $7.5 million from "income redistributing" regulation.

The gains from regulating entry are another matter. Without any regulation at all in the pipeline industry, it would be expected that local monopoly pipelines would make extra-normal profits until other, newer lines impinged on their market areas. The additional transporters would reduce profits to normal levels by reducing prices, but also by duplicating the facilities of existing transporters to the point where average mileage costs move up to the existing price level. With effective price regulation, there should be strong disincentives for such entry to take place, because regulated prices would be reduced to the level of lowest costs for the single transporter. There is no need for strict entry controls designed to prevent duplication unless price regulation is ineffective.

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[1] That is, $(.35)(.30)($14.69)(10^6)$ equals $1.5 million.

The "price reducing" and "quality" regulation activities of the Commission have been mutually exclusive, particularly because there has been so little done except rate and entry limitation in the gas pipeline industry. Both have had the goal of reducing costs from competition when there have been real gains possible from economies of scale in the single transporter. In the precedent cases, the proceedings have unfortunately centered on limiting competition by making market-like choices as to the single source of supply, but without reference to the alternative resource costs; Russell has shown this in three important and recent certification case decisions of the Commission.[1] The main issue was not encountered: to the extent that price regulation was effective in these instances of two transporters seeking to provide the same service, entry regulation was redundant.

The Federal Power Commission makes no claim for cost savings from limiting entry. Also, the Commission reports no significant improvements in the quality of service from more regulation; indeed, the impetus for quality improvement in pipeline safety has come not from the regulatory Commission but from Congress and private researchers. All that can be assumed at this point is that the gains have all been made by price regulation, whether or not price control has been "perfect".

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[1] Cf. Milton Russell, "Resource Allocation in Utility Certification Decisions", M.S.U. Public Utilities Studies (E. Lansing, Michigan, 1969), pp. 33-38.

A Review of Costs and Benefits, And an Economic View of Commission Reform

The impression gained from the Federal Power Commission's activities and the responses of companies in the electric power and natural gas industries has been one of vigorous and meticulous enforcement of regulation. All that activity cost at least $46 million during a typical year in the late 1960's. The expenditures were made to protect the consumer, and some consumers appear to have gained while other consumers and stockholders lost. The benefits from Commission-initiated price reductions were not only diverse within a Commission program, but also less than the costs of regulation in some but not in other programs.

The detailed accounting for benefits and costs in Table 3 points out the areas of Commission activity most out of balance. The Commission's activities in the pricing of electric power required $3 million of litigation expenses, half of which were outlays of the regulated companies defending themselves in "cost of service" reviews or rate cases. In return, the consumers received $4 million of indirect additions to income and $1 million of surplus from (imputed) gains in output. It would appear that $3 million of legal resources were used to produce only $1 million of additional net value of product here. The rest of the gains were from F.P.C. taxation -- from reducing the incomes of dividend recipients and increasing those of consumers. Other tax authorities have the same mandate, and most probably lower costs for completing the mandate.[1]

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[1] The costs of particular procedures in power regulation are perhaps much greater than benefits from those particular procedures, and much greater than the average benefits and costs show. Correspondence with the power companies on their costs of regulation pointed to certification procedures which duplicated the work of state commissions completely with zero benefi

Table 3: The Annual Costs and Benefits of Regulation

Federal Power Commission Activity	F.P.C. Costs ($ millions)	Company Costs ($ millions)	Benefits: Income Redistribution ($ millions)	Benefits: Efficiency ($ millions)
1. Electricity price regulation	1.6	1.6 (0.2 to 3.1)*	4.0 (2.7 to 4.0)*	1.3 (0 to 1.3)*
2. Electric power systems evaluation	1.3	1.9	***	***
3. Gas field price regulation	3.1	30.0 (30.0 to 78.0)*	63.0 (63.0 to 0.0)	-12.0 (-12.0 to 0.0)
4. Gas pipeline price and systems regulation	3.5	2.5	7.5	9.4
5. General Commission administrative services	1.1	0.0	***	***
Total	10.6	36.0	74.5	- 1.3
Alternative Total (assuming zero Benefits on number 3.)			11.5	10.7

* range of costs or benefits

*** no estimate available

Field price regulation procedures have been burdensome in every case, beginning with certification of firm sales of new reserves and continuing with the rate proceedings. The Commission spent more than $3 million on these activities in 1968. The indirect expenses of the companies, from delays in production imposed by certification and review, and the direct expenses of certification requirements and litigation, probably came to $30 million that year. The benefits directly depended on the extent of price reductions achieved under area rate rulings. If prices were so reduced as to create shortages, then consumer losses on output exceeded $12 million and income distribution gains exceeded $63 million. Once again, extensive resources (almost $33 million) were used up to redistribute amounts of income not much greater ($63 million). But there may have been no excess demand from reduced prices; in that case there were no benefits (as shown by the alternative totals in Table 3).

In comparison, the results from pipeline regulation were excellent. For no more than $6 million of annual outlay on certification and rate review, the Commission made contributions to consumer rate reductions modestly estimated to be worth more than $9 million in increased consumers' surplus and $7 million in income redistribution.

The Federal Power Commission must make its own calculations, if only to provide a check against those attempted here. If they do, they may again see the effects from the imbalance of regulatory activities. Gas field price regulatory activities must be ten times more costly than those in the "orthodox" public utilities; that alone

should raise questions as to whether the bureaucracy either in or engendered by field price regulation has not grown too fast and too large. The costs of redistributing income must be more than $33 million -- far more than any levy for collecting income by the Internal Revenue Service.

The question is whether the Commission and the rest of the Government see in the imbalance of benefits and costs from gas field regulation a lesson in economic reform. Those activities which make the direct and indirect expenses of producer regulation so great could be curtailed. The case for price and quantity review on the signing of a sales contract by a (regulated) producer with a (regulated) pipeline buyer is exceptionally weak. A social costs-receipts analysis of the crudest sort shows the unsatisfactory state of affairs here. This puts the alternative to the Commission: regulation of field prices by automatically certifying all competitive transactions, so that other agencies then can move on to redistributing income. The means are available for doing so in Commission interpretation of the Supreme Court's mandate for producer regulation; as elucidated by Commissioner O'Connor in the Permian Basin Case, "a market price has been established which provides a reasonable measure of the rate necessary to elicit supply... There is no substantial difference between market and costs in the Permian. Either method is presently permissable for purposes of area ratemaking."[1] The Federal Power

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[1] Commissioner O'Connor, op. cit., p. 265, (emphasis added).

Commission has the power to reduce its own scale of activities by centering its factual inquiry on determining the competitiveness of markets and then approving all competitive market prices. The costs of regulation would be reduced to a size comparable to those in electric power and gas pipeline regulation. Then the policy decision has to do with the wisdom and courage required of an agency to reduce itself to one fifth present scale.

The same "agonizing reappraisal" should be conducted on electricity price regulation. This regulation applies only on interstate transmission of power for wholesale distribution to local utilities, and regulation has been established now for a decade, so that the market conditions and the issues are not quite the same as those in finding ceiling prices on thousands of gas field sales for the first time. But the only net benefits are those found in income redistribution, and these taxation-like gains are at the expense of more than $2 million of litigation and administrative resources.

There are two arguments for and as many counterarguments against continuing the day-to-day surveillance procedures in electricity regulation as they now operate. First, they have the effect of preventing widespread evasion of the rules given in the important precedent cases, merely by taking place. But suppose they did not? Then evasion could lead to prices perhaps 15 per cent to 20 per cent higher on wholesale distribution of power, without costing as much in resources as is used in present litigation and review.[1] Second, they

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[1] The vertical distance or ordinate in triangle "B" in Figure 1, when the area of that triangle does not exceed the costs of regulation of $3 million.

resulted in the consumer obtaining more than $4 million of present value of price reductions in a typical year. But if this were not the case, then the government itself would have had the present value of twice this amount in tax receipts on "extra normal" electricity profits in a typical year. Admittedly, these taxes could be collected elsewhere. This is a two-sided argument: the "tax" collected by the F.P.C. and passed through to the consumers could also have been collected by the Internal Revenue Service via even higher profits levies, but with lower collection costs. The arguments are, at the most, unsettled in the case for wholesale electricity regulation as it now operates.

Then what can the Commission do? The mandate is present, tentatively at least, for continued day-to-day control of pipelines rates and service (as in Table 3). The mandate is present and untested to improve the quality and add to the quantity of service provided by the pipeline and electric power companies. The next decade will see the Federal Power Commission engaged in the search for more low cost power and gas -- where the costs include those imposed on others using air and water resources appropriated by the utilities. Otherwise, the next decade will see the Commission not at all.